At the outset, a brief review of the Applicants' invention is believed helpful in resolving prosecution issues. The Applicants' valve is a valve of the free draining type which is used to control fluids which may be corrosive or toxic. The materials of construction must resist the process fluids and drain so that minimal fluid remains captured within the valve. The Applicants' throttling valve has a inlet and outlet with an island between which forms a throttling surface. A diaphragm has a primary and secondary surface which are joined at their edges and captured by the valve body. The surface of the primary diaphragm surface cooperates and mates with the island so as to avoid sharp corners and establish a short flow path. The diaphragm members are a thin-walled, flexible membranes. The primary membranes seats on the island to close off the flow path and will progressively retract from the island to offer decreasing resistence to flow. The diaphragm is a unitary structure with the primary and secondary surfaces being joined along their edges so they may be captured by the body of the valve when assembled. The volume chamber within the diaphragm between the surfaces is vented to the exterior through a weep hole so that any leakage may be immediately detected. The secondary diaphragm surface acts as a safety feature to prevent fluid leakage into the upper valve body section which contains the motor and operator in the event of failure of the primary diaphragm.

Turning now in consideration of Linder, et al, the Examiner points out that Linder discloses a primary diaphragm 52, throttling diaphragm 92 and a weep hole. Reviewing the Linder patent in detail, it will be seen that the valve of Linder is a plastic poppet valve

A

located in a seat having a lower diaphragm with an upwardly extending stem. A valve operating shaft 56 extends upwardly through the diaphragm 52. Diaphragm 52 may have an integral "O" ring. A passage communicates with a vent opening into a vent space above the diaphragm 52.

A second and separate plastic valve operating diaphragm is seated above the lower diaphragm having a central aperture through which passes the valve operating shaft. Piston 96 is located below the diaphragm. On the topside of the diaphragm 92, a top piston is located and which is held against the diaphragm by a nut. An area 106 is located in the control housing and is communication with the underside of upper diaphragm 92. Pressurized air may be introduced in the inlet to overcome the bias of spring 104 and lift the pop-it away from the valve seat. The embodiments of Figures 4 and 5 are similar in construction.

As pointed out above, the object of the Applicants' design is to achieve a linear throttling characteristic in a free-draining, double-diaphragm valve with minimal fluid capture particular when highly corrosive or toxic fluids are being handled.

Linder, et al, show a complicated construction in which failure of the lower diaphragm will result in the valve components being exposed to corrosive fluids. Linder, et al, also suggest that an "O" ring is required for sealing off the operating shaft from corrosive fluids.

Linder, et al is basically a simple poppet-type valve which, as discussed at length in the specification which will cause shear as fluid is forced through the gap between the

A

edges of the poppet valve and the annular seat. In such a case, fluid is accelerated in the gap at its peak velocity is reached and is decelerate in the outlet section. The design of the Applicants' valve avoids this by throttling fluid between two annular surfaces of significant area. Thus, the acceleration of fluid in the throttling region is minimized. The discharge of the throttling region is a large diameter annulus such that discharge velocity is lower than the entry point to the throttling surfaces having the effect of minimizing velocity changes and less fluid shear.

Applicants' valve provides a very small volume or chamber space between the diaphragm surfaces. In contrast, the Linder, et al, valve has a large volume space in the region between the diaphragms. The problem with valves such as Linder, et al, is that a comparatively large volume of leakage can pass the primary diaphragm before being detected in the weep hole. With Applicants' device, the diaphragm volume chamber will provide immediate detection of leakage.

In summary, one significant feature of the Applicants' valve is the diaphragm construction which is set forth in new Claim 9. As pointed out above, this diaphragm construction has dual spaced-apart surfaces which are joined at the periphery at a sealing component. No suggestion of this construction appears in Linder, et. al.

The surface of the primary diaphragm surface is contoured to match the features of the throttling island. Linder, et al, type valves and other prior art diaphragm valves are essentially flat membranes. They must stretch and compress as they reposition. The Applicants' design provides small ripples that deform or bend rather than stretch. Stretch

A

and compression is much more life-limiting to plastics in simple bending. This feature is set forth in Claim 18.

The remaining Claims 10 through 17 are dependent and specify only additional features such as preloading (Claim 7), inclusion of a weep hole (Claim 10), use of chemical resistant materials (Claim 14), use of a stepper drive (Claim 16) and the like. These claims are urged allowable for the reasons set forth with respect to Claim 9.

A petition fee for a two month extension accompanies this Response.

A favorable action is respectfully solicited.

Respectfully submitted,

Dated: 5/16/01

Gregory J. Nelson, Reg. No. 22,066
NELSON & ROEDIGER
Attorneys for Applicant
3333 E. Camelback Road, Suite 212
Phoenix, AZ 85018
(602) 263-8782